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proposition takes the following form: *The diameter passing through a variable point of a parabola, meets the tangent at the vertex in the point P. The parallel through P to the line joining M to the vertex of the parabola, envelops another parabola having the same vertex and the same axis as the given curve.*

The proposed problem is another special case of this general proposition, namely when both A and B are at infinity.

The duals of the three propositions are, in order:

*The points of intersection of two fixed tangents to a given conic, with a variable tangent to the same curve, are projected from the points where the fixed tangents touch the conic. The point of intersection of the two projecting lines describes a conic having a double contact with the given curve.*

*From a variable point of the tangent at the vertex of a given parabola, are drawn the diameter and the tangent to the curve. The point of intersection of the diameter with the parallel to the tangent through the vertex of the curve, describes a parabola having the same axis and the same vertex as the given curve.*

*The parallels to the asymptotes of a given hyperbola drawn through the points of intersection of the latter lines with a variable tangent to the curve, intersect in a point whose locus is an hyperbola having the same asymptotes as the given curve.*

Also solved by O. S. ADAMS, CLARA L. BACON, J. W. CLAWSON, A. M. HARDING, HORACE OLSON, PAUL CAPRON, G. W. HARTWELL, R. M. MATHEWS, and N. P. PANDYA.

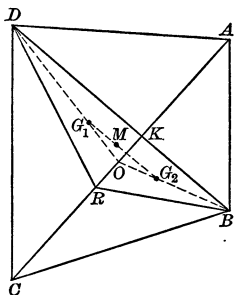
**490. Proposed by ELMER E. MOOTS, University of Arizona.**

In any quadrilateral ABCD, let AC and BD be the diagonals intersecting at K. On AC, lay off CR equal to AK. Join B and R. Connect the middle point G of BR with D. On GD lay off GM equal to  $\frac{1}{3}GD$ . Show that M is the center of gravity of the quadrilateral.

SOLUTION BY A. M. HARDING, University of Arkansas.

It is evident that M is the center of gravity of the triangle BDR. Hence it will be sufficient to prove that the triangle BDR and the quadrilateral ABCD have the same center of gravity.

Let O be the mid-point of RK, then it will also be the mid-point of CA. Then  $G_1$  is the center of gravity of the triangles RDK and CDA, and  $G_2$  is the center of gravity of the triangles RBK and CBA where  $OG_1 = \frac{1}{3}OD$  and  $OG_2 = \frac{1}{3}OB$ .



Since

$$\frac{\triangle RDK}{\triangle RBK} = \frac{\triangle CDA}{\triangle CBA},$$

it follows that the center of gravity of the triangle BDR will also be the center of gravity of the quadrilateral ABCD.

Also solved by J. W. CLAWSON, O. S. ADAMS, and N. P. PANDYA.

**491. Proposed by N. P. PANDYA, Sojitra, India.**

In a triangle  $mx = b$  and  $nx = c$ , determine a relation between  $m$ ,  $n$ ,  $x$ ,  $A$  and  $s$ , and solve it for  $x$ .